ORDER NO. SD7812-1486

Service Manual

SP-15

QUARTZ Synthasizer
Direct Drive Turntable

SP-15 (M), (MC)

- The model SP-15 (M) is available in America only.
- The model SP-15 (MC) is available in Canada only.

Specifications (Specifications are subject to change without notice.)
(Weights and dimensions shown are approximate.)

General

Power supply:	120V, 50 or 60 Hz
Power consumption:	11W
Dimensions:	34.9 x 9.3 x 37.2 cm
(W x H x D)	(13-3/4x3-21/32x14-41/64 inches)
Weight:	6.2 kg (13.7 lb)

Turntable section

Type:	Quartz synthesizer pitch control Direct drive
Drive method:	Direct Drive
Motor:	Brushless DC motor
Drive control method:	Quartz-phase-locked control
Turntable platter:	Aluminum die-cast, diameter 33.9 cm (13-11/32 inches) weight 2.7 kg (5.9 lb)
Moment of inertia:	380 kg·cm^2 (130 lb·in^2)
Turntable speeds:	33-1/3, 45 and 78.26 rpm
Turntable speed fine adjustment:	Adjustable up to ±9.9% in 0.1% increments by digital indication
Starting torque:	3 kg·cm (2.61 lb·in)
Build-up time:	0.4 sec. to 33-1/3 rpm
Braking time:	0.4 sec. from 33-1/3 rpm
Braking system:	Electrical and Mecanical braking
Speed fluctuation due to load torque:	0% within 2.5 kg·cm (2.2 lb·in)
Speed drift:	Within ±0.002%
Wow and flutter:	0.025% WRMS (JIS C5521) ±0.035% peak (IEC 98A Weighted)
Rumble:	−56 dB (IEC 98A Unweighted) −78 dB (IEC 98A Weighted)

Technics

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■ DIMENSION DRAWING

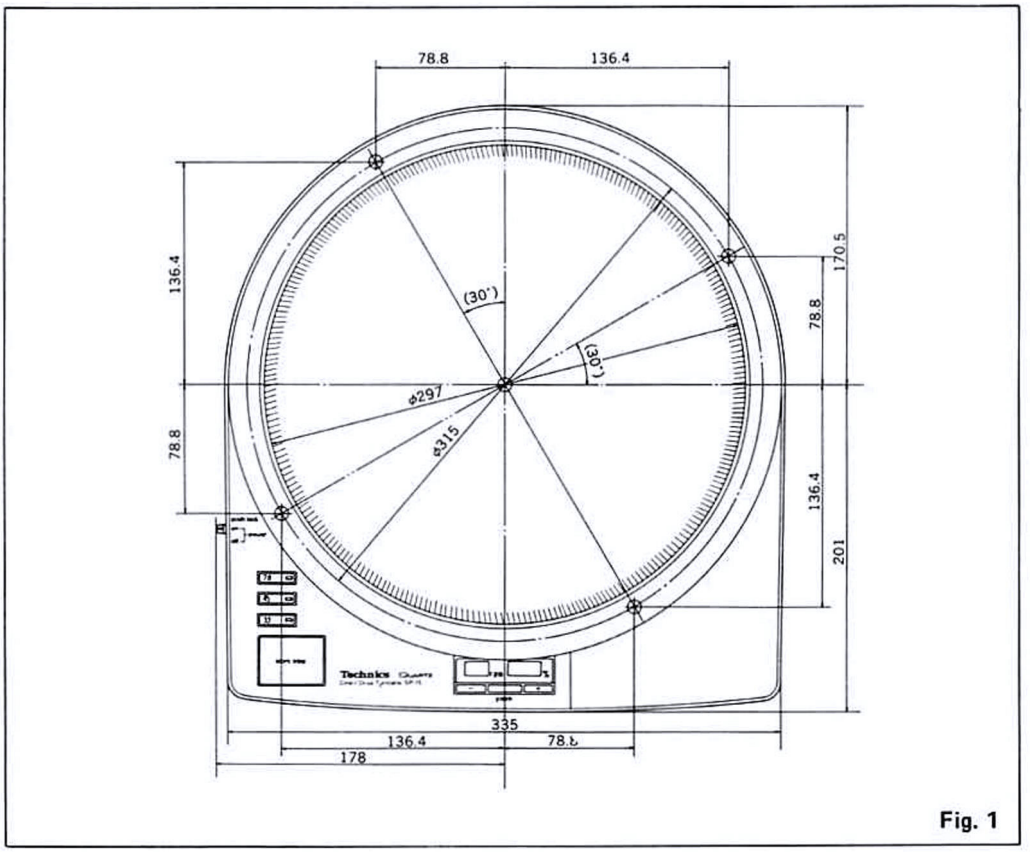


Fig. 1

NOTE:

- Secure the main body with the attached 4 setscrews. When other setscrews are used, find suitable ones in accordance with the dimension drawing.
- In order to make the best use of this turntable, employ a sturdy cabinet (turntable base) which sufficiently withstands the load.

* It is recommended to use the optional turntable (SH-15B1) as the cabinet for SP-15.

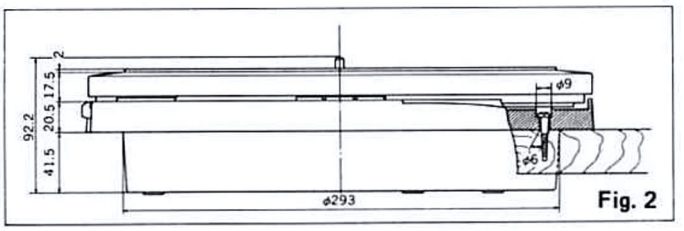


Fig. 2

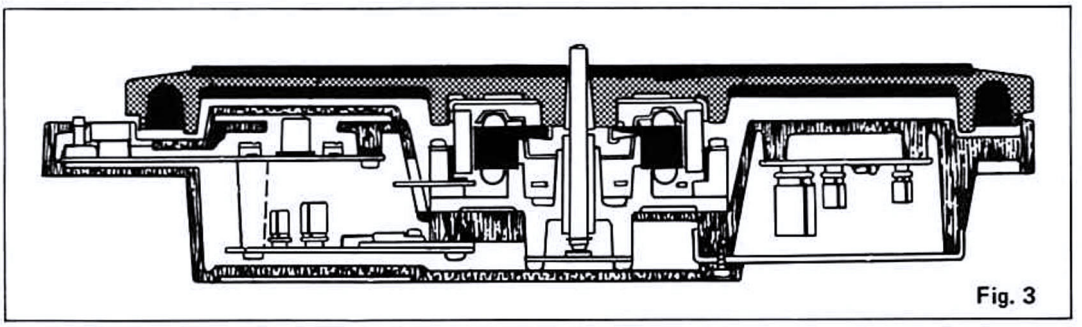


Fig. 3

■ HOW TO OPERATE

1. Set the Power switch/pitch lock knob to the **"on"** position. **(See Fig. 4.)**

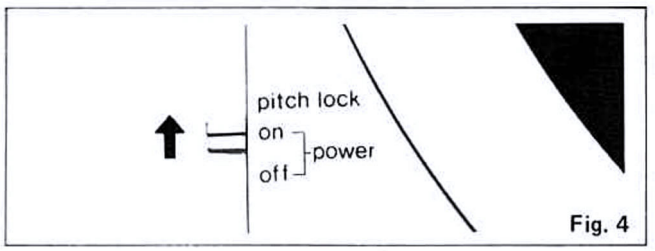


Fig. 4

The revolutions are indicated at 33 (33-1/3 rpm.) of the speed selector knob and digital speed indicator. **(Fig. 5.)**

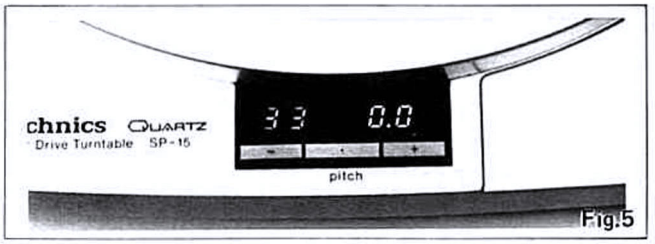


Fig. 5

Upon setting the power switch/pitch lock knob to **"on"**, the revolutions are changed over to 33-1/3 rmp. at all times. If the record to be played is other than a 33-1/3 rpm., depress the speed select button to suit the phono disc to be played.

When the power switch/pitch lock knob is set to **"pitch lock"**, the pitch control button and speed select button are locked so as not to be actuated even if the buttons are accidentally touched during playing. **(See Fig. 6.)**

Therefore, for selecting the speeds or operating the pitch control, first set the power switch/pitch lock knob to the position **"on"**.

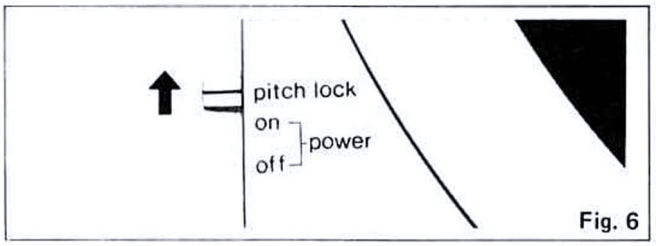


Fig. 6

2. Place a record on the turntable mat.
   Push the start • stop button. **(See Fig. 7.)**
   The turntable platter will begin to rotate and reach its constant rotation speed 0.4 sec. (33-1/3 rpm.).

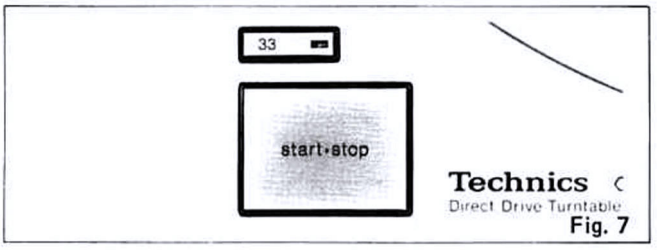


Fig. 7

3. Upon completion of playing, depress the start • stop button.
   The turntable is instantly (0.4 second) stopped by the double brake system.
4. After that, set the power switch/pitch lock knob to **"off"**. **(See Fig. 8.)**

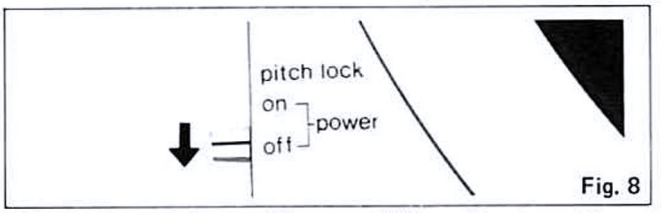


Fig. 8

Pitch control (turntable speed fine adjustment).

The Quartz synthesizer system is being employed for the first time in the world. A high degree of pitch control accuracy over a wide range (±9.9%) in 0.1% increments can be obtained with the quartz perfectly locked.

The pitch control is continuously variable up to 9.9%.

The pitch variations which are clearly indicated by the LED digital indicator provide you with accurate and easy selection.

The pitch control can be selected in increments of 0.1% which is below the threshold of human perception. **(See Fig. 9.)**

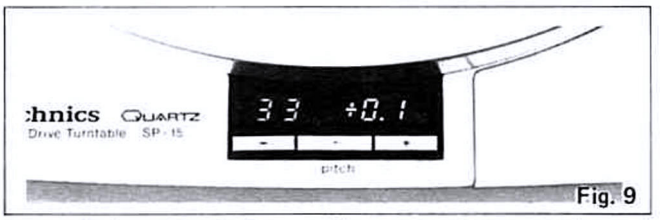


Fig. 9

The pitch control also enables you to accurately and precisely tune musical instruments and by varying the pitch slightly, to obtain a different musical note from the record. **(See Fig. 10.)**

For a half-tone change:

+5.9% (#)

−5.6% (♭)

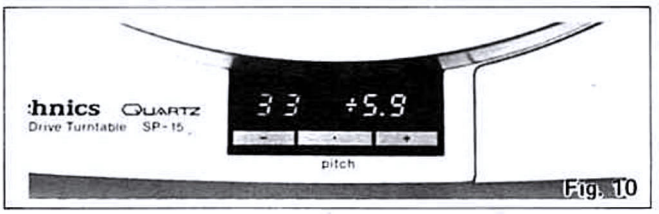


Fig. 10

Another feature of the variable pitch control over a wide range of ±9.9% is that it makes singing along with a melody easy for a chorus, or for playing a record for accompaniment only. **(See Fig. 11.)**

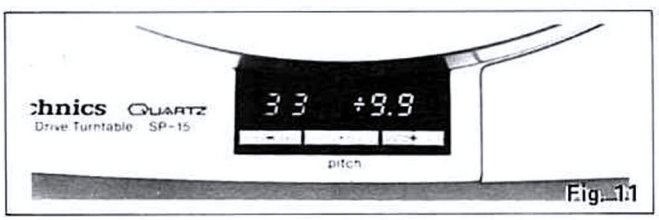


Fig. 11

By pressing the clear button which is located between the "+" and "−" pitch buttons, you can quickly return the set to normal palying speed. **(See Fig. 12.)**

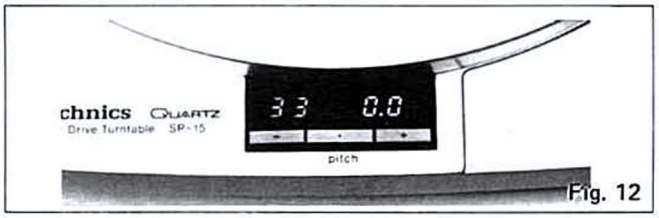


Fig. 12

SP-15

■ FEATURES

Quartz synthesizer system that for the first time in the world has made it possible to achieve a digital pitch control of ±9.9% in 0.1% increments

In conventional quartz players the quartz reference was in effect only within strictly limited ranges: whenever vernier speed change was required, the quartz circuit had to be switched off. In the Technics SP-15, we took the lead by locking the quartz, thus making it possible to effect a high degree of pitch control accuracy over a range as wide as ±9.9% in 0.1% increments, which is below the threshold of human perception.

Moreover, the pitch control, coupled with the clear digital indicator, enables you to accurately and precisely tune with musical instruments, vary pitch slightly for obtaining a musical note from a record or alter tones by a half-note.

Oversized turntable that cuts off and absorbs external vibrations.

Based on analyses of the turntable vibration modes and vibrations in the sound range, a special viscoelastic material is applied to the reverse surface of the turntable platter for deadening.

The deadening material is applied to the undersurface and outer periphery of the turntable platter, with the rubber turntable mat on the surface settled into the turntable platter. This design is superior in acoustic characteristics even at high sound levels through elimination of turntable resonance and absorption of external vibration.

Moreover, the oversized aluminum die-cast turntable platter, 33.9 cm (13-11/32") in diameter, is heavy with 2.7 kg (5.9 lb.) of its own weight, with a moment of inertia of 380 kg cm^2 (130 lb. in^2) for large heavy weight class design.

Vibration damping structure by the precision aluminum die-cast cabinet and TNRC.

The acoustical characteristics of the player system are inevitably affected by the turntable platter and cabinet employed. The SP-15 adopts an aluminum die-cast cabinet superior in strength, with high processing accuracy, and the new acoustic material TNRC excellent in acoustical properties. Through cutting-off and absorption of external vibrations, the unit is designed for improved acoustic characteristics, with susceptibility to feedback minimized.

Electronic circuits of more than 3,000 discrete elements concentrated into 4ICs

The 4 kinds of IC, i.e., Synthesizer pitch control CMOS LSI (MN 6042), Frequency dividing IC employing I^2L, ECL (DN 860), phase speed control IC (AN 660) and Driving IC (AN 640) into which high density electronic circuits of more than 3,000 discrete elements have been compressed have made it possible to produce this high precision quartz turntable.

Quartz Controlled Rotation Accuracy

The SP-15 utilizes the oscillation of a quartz crystal as a reference signal or source. This oscillation is not affected by temperature change or power fluctuations. By synchronizing the rotation of the turntable platter accurately to the reference signal, speed drift of the unit is held within ±0.002%.

Technics' unique motor construction in which the rotor of the motor is integrally formed with the turntable

High torque motor of 3 kg·cm with starting time of 0.4 second is capable of instant speed change-over (at 33-1/3 rpm.).

With the double braking system of the electronic brake and mechanical brake, the turntable stops instantly (0.4 second) upon depression of the start • stop button (at 33-1/3 rpm.)

High performance with wow and flutter of only 0.025% (JIS C5521) and rumble of −78 dB (IEC 98A Weighted).

Pitch lock mechanism capable of locking the speed selection and pitch control operation

Malfunction caused by accidental touching of the operating portion during playing, can be prevented.

Highly efficient pulse power supply circuit is employed for the DC power source

Since DC voltage is obtained by oscillating high frequency (20 kHz) through direct rectification of AC power supply for voltage conversion at the pulse transformer, there is no leakage of the commercial power source frequency.

Stable and positive mechanism that can stand frequent use for business use, etc. and a switch section with point contacts.

Revolutions at 3 speeds of 33-1/3, 45 and 78.26 rpm. are employed, taking into account business use.

■ RUBRICATION

Apply 2 or 3 drops of oil once after every 2000 hours of operation. **(See Fig. 13.)**

This time interval is much longer than that of conventional type motors (200–500 hours).

Please purchase original brand of oil (Parts number is **SFWO 010.)**

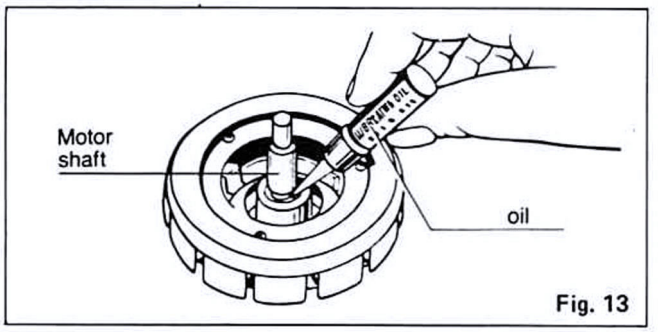


Fig. 13

■ TECHNICAL DESCRIPTION

• Description of pulse power supply circuit

The pulse power source directly rectifies the commercial power with diode to make DC 168V. And it generates pulses (approx. 20 kHz waves) by switching the DC 168V with the special high-voltage withstanding, high-speed switching transistor. Thus, the circuit serves to drive the power transformer with the switching pulses in order to obtain the specified voltage on the secondary side.
Fig.14 shows a pulse power supply block and a conventional power supply block.

Power supply circuit blocks

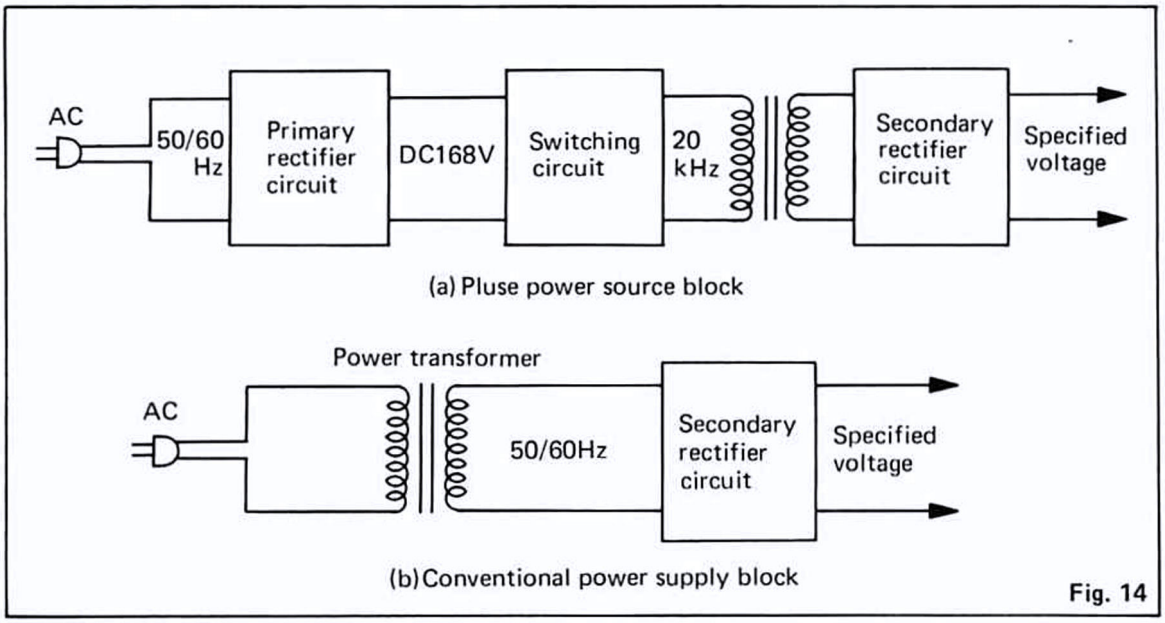


Fig. 14

• Pulse power supply circuit of SP-15

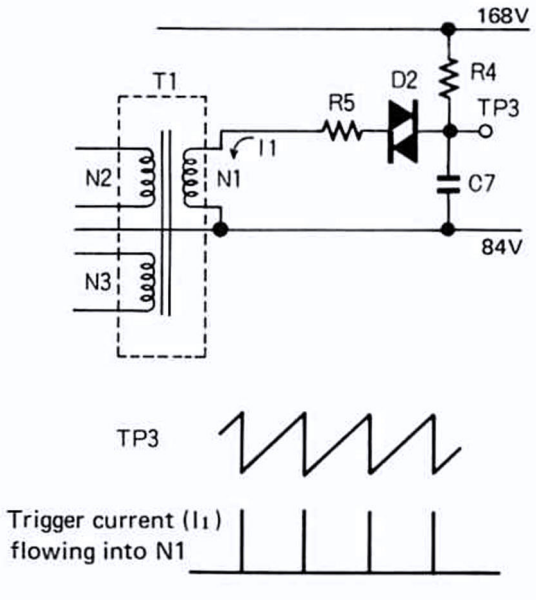


Fig. 15

1. With power supply turned ON,
C7 is charged through R4. When the charged voltage becomes high enough to turn on trigger diode D2, current (I1) flows through R5. Then, C7 is discharged and, therefore, it is again charged through R4. As the operations are repeated, trigger current flows into N1 as shown in Fig. 15.

* **Trigger diode**

When a voltage higher than the specification is applied between terminals T1 and T2, it works to flow a current irrespective of the polarity.

• Switching circuit operation

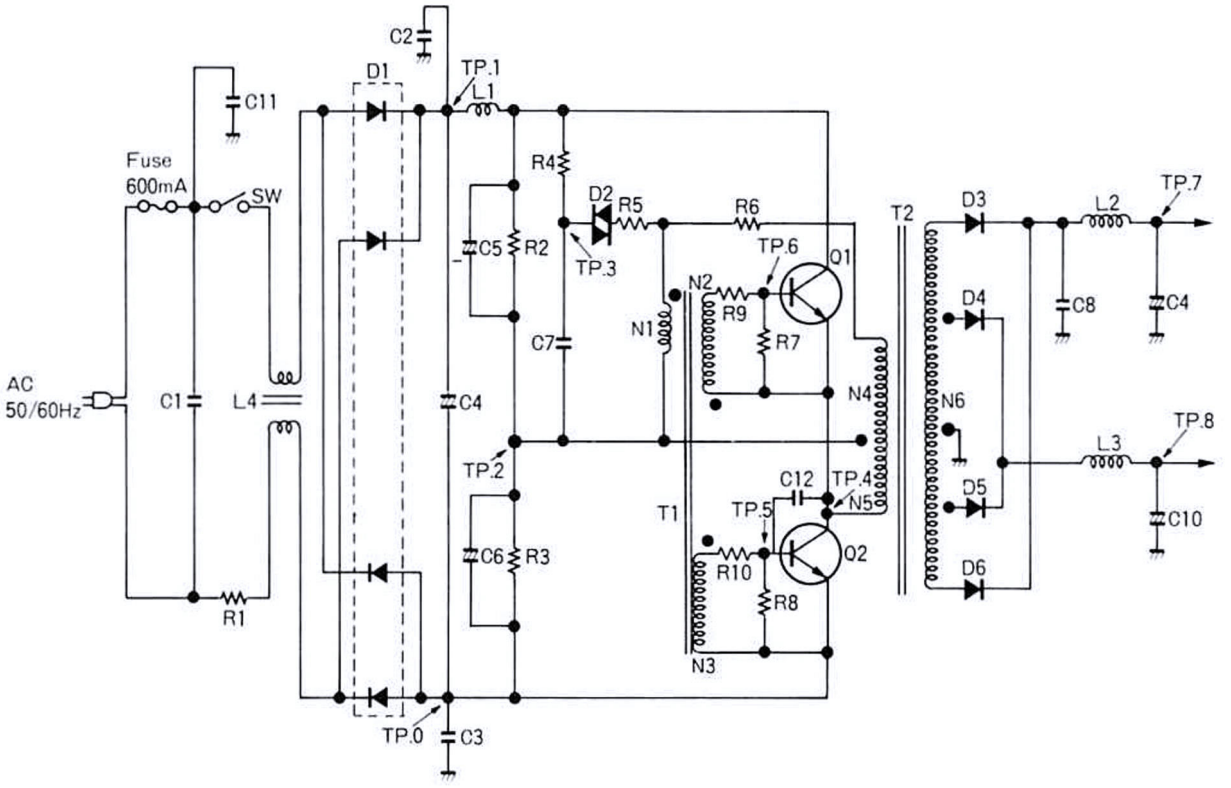
❶ Commerical power (50/60Hz) is rectified by D1 and D4 through line filter L4 to obtain DC 168V. The DC 168V is divided by R2 and R3 so that TP. 0 = 0V, TP. 2 = 84V and TP. 3 = 168V.

❷ C7 is charged through R4. When trigger diode D2 reaches "on" level, the trigger current flows from D2 to N1 via R5. Since the coils of N2 and N3 are reverse in phase, when a current flows into N1 in the direction of ↓ , the base current is generated at N2 and N3 so that Q1 and Q2 are respectively reverse- and forward-biased.
Therefore, Q1 turns off and Q2 turns on, and the primary current of T2 flows from N1 → N5 → Q2 (C-E) → TP. 0. At that time, a feedback current is generated at N4 and it flows into N1 through R6. The current flowing into N1 becomes of positive feedback, then Q1 and Q2 keep turning on, and the collector current of Q2 keeps increasing in accordance with the inductance of N5.

❸ However, N3 is directly connected between base and emitter of Q2, proximately being short-circuited, therefore, the feedback current is saturated at a given value determined by R6. Accordingly, the base current of Q2 decreases in accordance with the inductance of N3. When the base current of Q2 is about to become smaller, the counter electromotive force is generated at N1, causing the feedback current to flow in the reverse direction, and then a positive feedback line is formed for Q1. Consequently, Q1 turns on and Q2 turns off, and the primary current of T2 flows from TP. 1 → Q1 (C-E) → N5 → TP. 2. Similarly, when the current is saturated, a positive feedback line is formed for Q2.

❹ Through repetition of the above procedure, the oscillation is continued and 20 kHz pulse voltage can be obtained at N6 on the secondary side of T2.

Fig. 16 Switching circuit
(•-mark shows the polarity of coil.)



■ DISASSEMBLY PROCEDURE

How to remove bottom cover and shielding plate.

1. Remove the turntable rubber and turntable, and then turn the main body upside down.
2. Remove 12 setscrews of the bottom cover. (See Fig.17.)

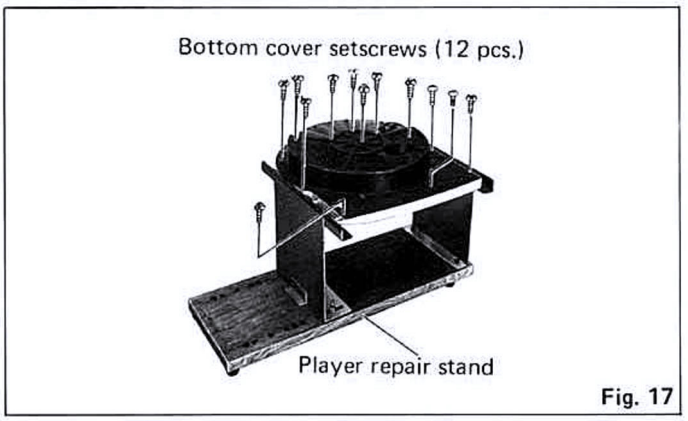


Fig. 17

3. **Remove 7 setscrews of the shielding cover.** (See Fig.18.)

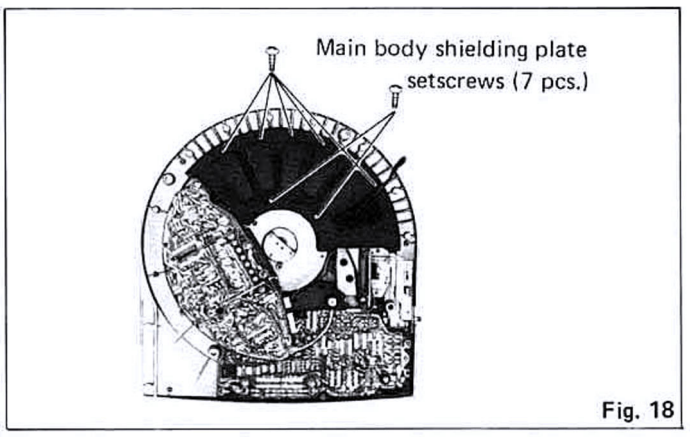


Fig. 18

How to remove drive circuit board (See Fig.19.)

1. Detach connector A from the solenoid, and drive connector B from the logical circuit board.
2. Remove 6 setscrews of the drive circuit board.
3. Remove the drive circuit board, and detach the motor drive connector and the power line connector from the drive circuit board. Thus, the drive circuit board can be removed.

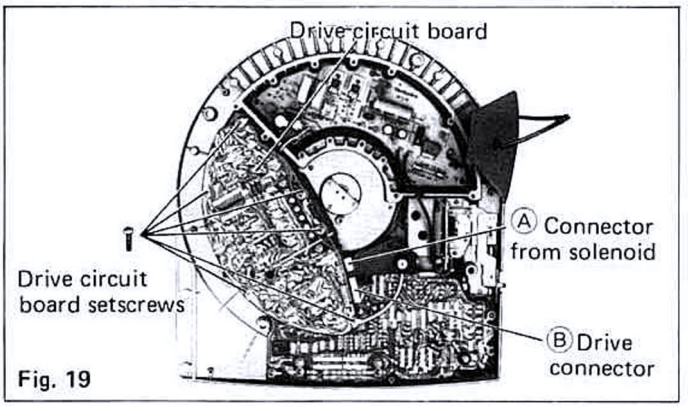


Fig. 19

How to remove power supply circuit board and logical circuit board (See Fig.20.)

1. Remove 5 setscrews of the power supply circuit board.
   Note: Take special care when disassembling the power supply section because the circuit board is supplied with a high voltage.
2. Remove 2 setscrews of the earth terminal plate.
3. Remove 7 setscrews of the logical circuit board.
4. Detach the logical circuit board and the 2P lock switch connector.

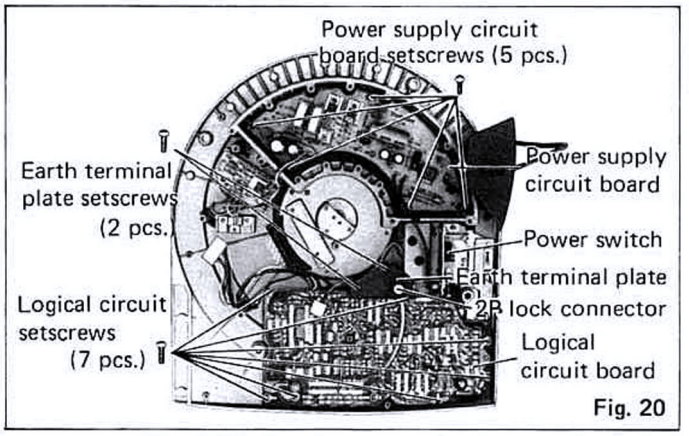


Fig. 20

How to remove stator frame

1. Remove the drive circuit board in accordance with the above-mentioned procedure.
2. Turn the main body up and remove 3 setscrews of the stator frame. (See Fig.21.)

(marked 3 setscrews)

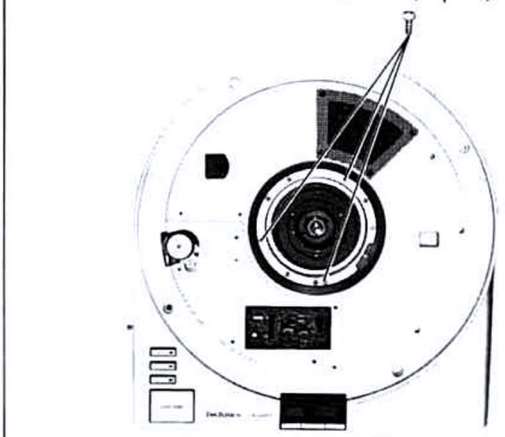


Fig. 21

Remarks:
For the disassembly of mechanical parts other than the above (such as power switch plate, brake operating plate, etc.), refer to the exploded views in this manual.

Repair of drive circuit and logical circuit (Figs. 22 and 23.)

1. Detach the bottom cover with reference to the disassembly procedure.
2. Put the set on the repair stand with its front up.
3. Mount the turntable.

Then, carry out the check of each part in accordance with the Trouble Shooting Chart. Also use a stroboscope when checking the number revolutions.

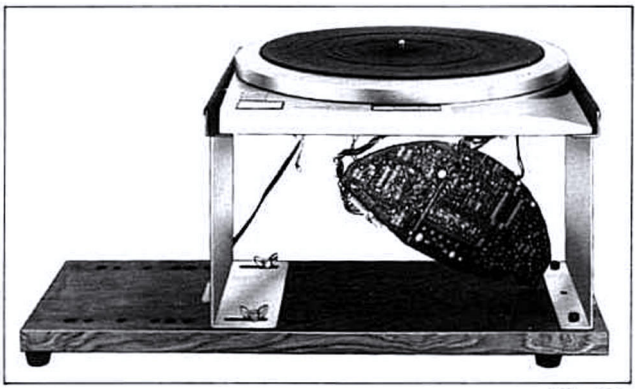


Fig. 22

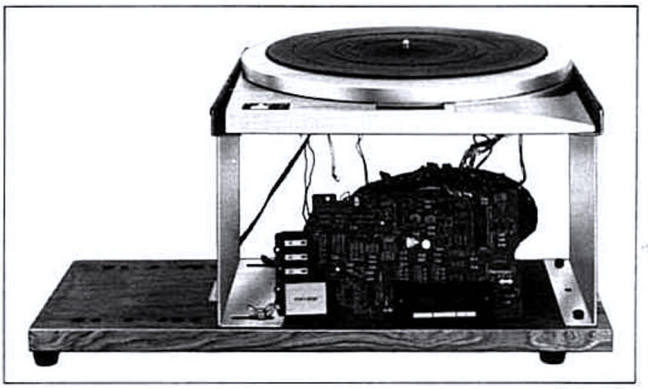


Fig. 23

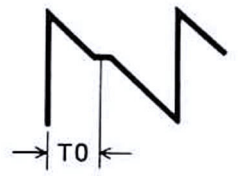
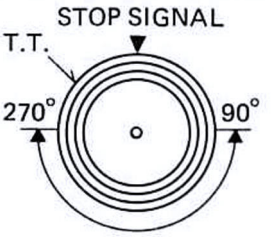
Repair of power supply circuit

1. Remove the bottom cover and the shielding plate with reference to the disassembly procedure.
2. Carry out the check of each part according to the Trouble Shooting Chart with reference to the test points printed on the power supply circuit.

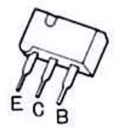
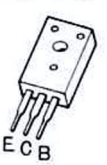
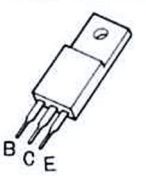
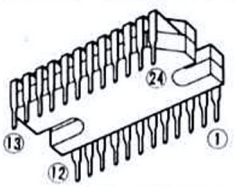
■ ADJUSTMENTS

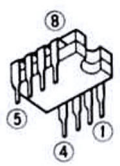
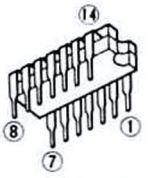
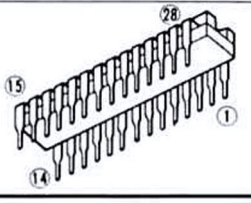
Adjustment Points of Electrical System

NOTE: Make the following adjustments after replacing parts such as IC's, transistors, diodes, etc.

	Adjustment	Connection Points	Adjustment Point	Adjustment Method
1	Adjustment of standard voltage (VS)	DC voltmeter or Oscilloscope ⊕ → TP18 ⊖ → GROUND	VR301	With the start switch set at ON, adjust VR301 so that the voltage is DC 2.10V ±0.01 at 33 r.p.m. Confirm that the voltage is 2.835V ±0.05V at 45 r.p.m. and 4.9V ±0.1V at 78 r.p.m.
2	Adjustment of current source (IR)	DC voltmeter or Oscilloscope ⊕ → TP19 ⊖ → TP21	VR201	Turn start switch on to begin turntable rotation. Adjust VR201 for 0 V potential difference of TP19 and TP21.
3	Tracking adjustment (TRACKING)	Oscilloscope ⊕ → TP18 ⊖ → GROUND	VR101	TP18 waveform  With the start switch set at ON, adjust VR101 so that 8 ≦ T0 ≦ 8.5 ms at 33 r.p.m. Confirm that 5.8 ≦ T0 ≦ 6.4ms at 45 r.p.m. and 3 ≦ T0 ≦ 4.5 ms at 78 r.p.m.
4	Braking adjustment (BRAKE)	——	VR202	 Adjust VR202 for complete stop within 90° ~ 270° after stop signal initiated. (Turntable becomes free a few seconds after stop.)

■ TERMINAL GUIDE OF TRANSISTOR AND IC

2SD636, 2SD639 2SB641, 2SB643	2SD592, 2SC828A 2SC1383	2SC1846, 2SA886 2SC1847	2SD712A-C 2SC1826	AN640G
 	 	 	 	

SVIUPC4558C	AN660, DN860	SVIMSM4013 SVIM53217P	MN6042
 	 	 	

• After-repair precautions

After completion of the repair, install the main body shielding plate and the bottom cover with special care. If their installation is incomplete, the AM broadcast or the cartridge will be interferred with noise because the power supply circuit uses 20 kHz for switching. In addition, the equipment should be carefully handled as it is supplied with a high voltage.

■ ADJUSTMENT OF MECHANICAL BRAKE

The mechanical brake has been already factory-adjusted before delivery. However, if the brake creates abnormal noise during operation or fails to work as specified, make its adjustment in accordance with the following procedure.

❶ Remove the turntable and the main body cover. (Refer to the exploded views.)
❷ Loosen the screw Ⓐ and put the turntable in place.
❸ Turn on the power switch and then regulate adjust screw Ⓑ through the hole in the turntable so that the brake shoe is about 1 mm off the turntable being released while turning on and off the start/stop switch. After that, tighten the screw Ⓐ completely.

The above procedure is enough to complete the adjustment of the brake operating position. But if the brake shoe is worn out, loosen the screw Ⓒ and properly shift the brake shoe.

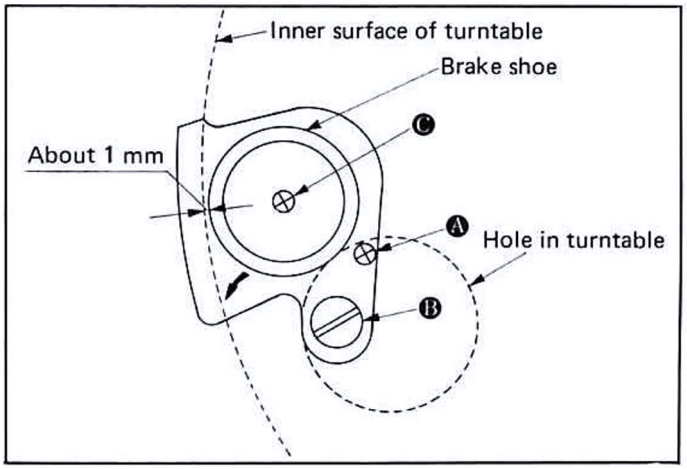
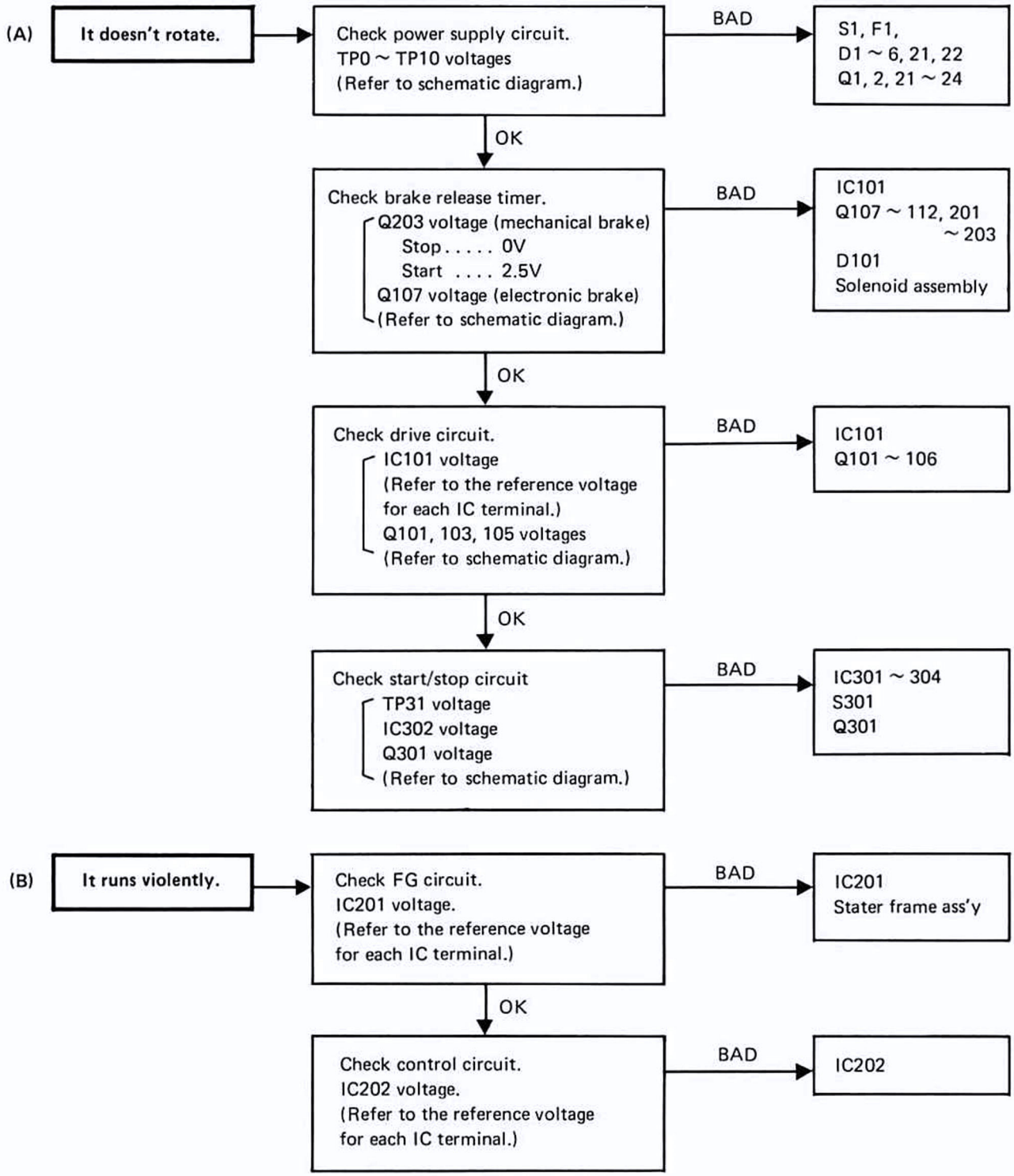


Fig. 24 Mechanical brake system

■ TROUBLE SHOOTING



(C) **Speed changeover is defective.**

→ Check speed setting circuit.
- IC303 voltage
- IC304 voltage
- (Refer to the reference voltage for each IC terminal.)

BAD → IC303, 304
S302 ~ 304

(D) **Pitch control is defective, causing uneven rotation**

→ Check crystal-controlled oscillator power supply.
TP35 - 9V

BAD → D315

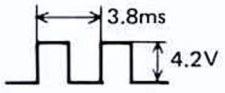
OK ↓

Check VCO power supply.
TP39 - 4.8V

BAD → D316

OK ↓

Check crystal-controlled oscillator circuit.



- TP37
- IC304 voltage
- (Refer to the reference voltage for each IC terminal.)

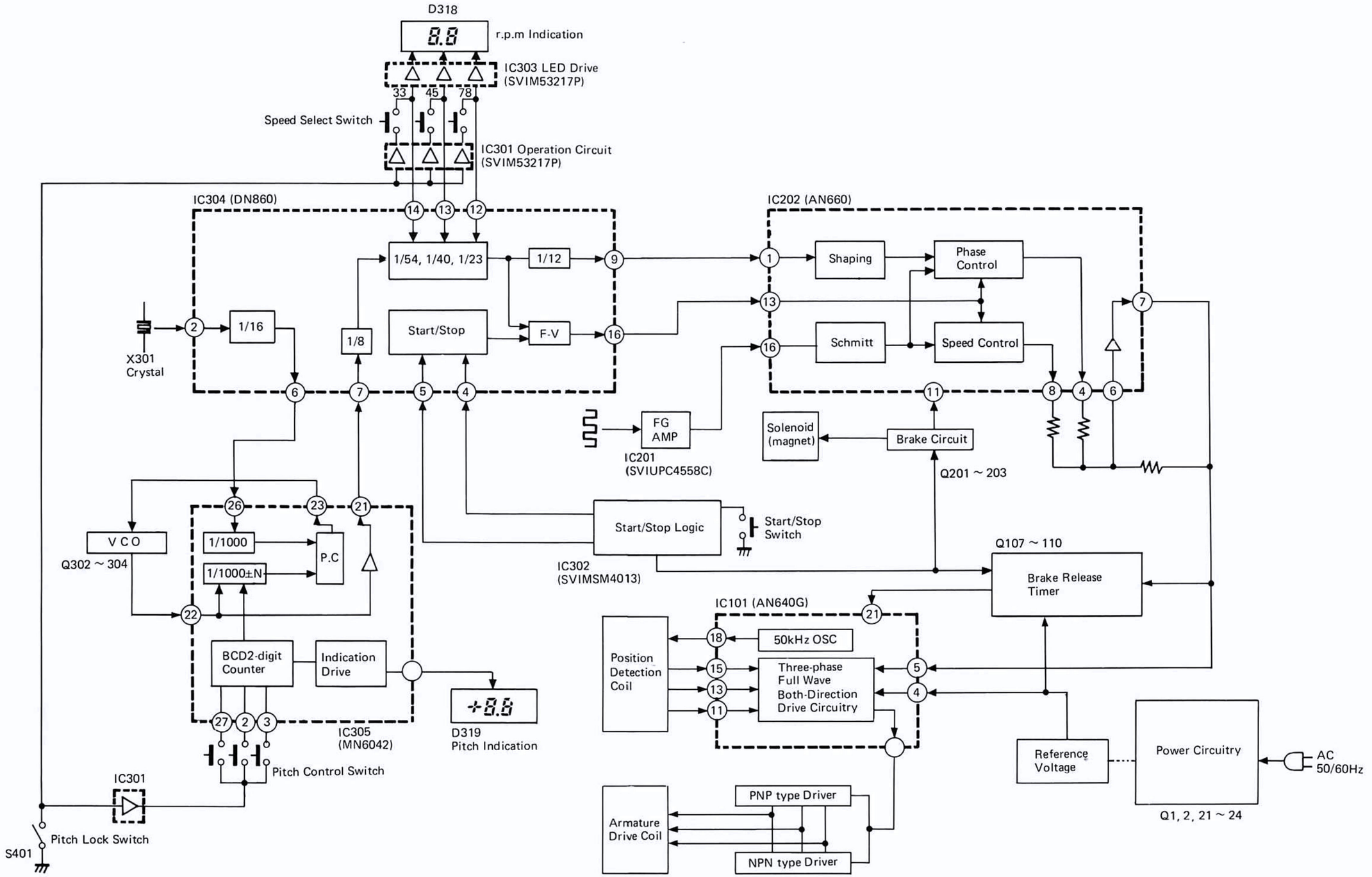
BAD → X301
IC304

OK ↓

Check pitch control circuit
- IC305 voltage
- (Refer to the reference voltage for each IC terminal.)
- Q302 ~ Q304 voltages
- (Refer to schematic diagram.)

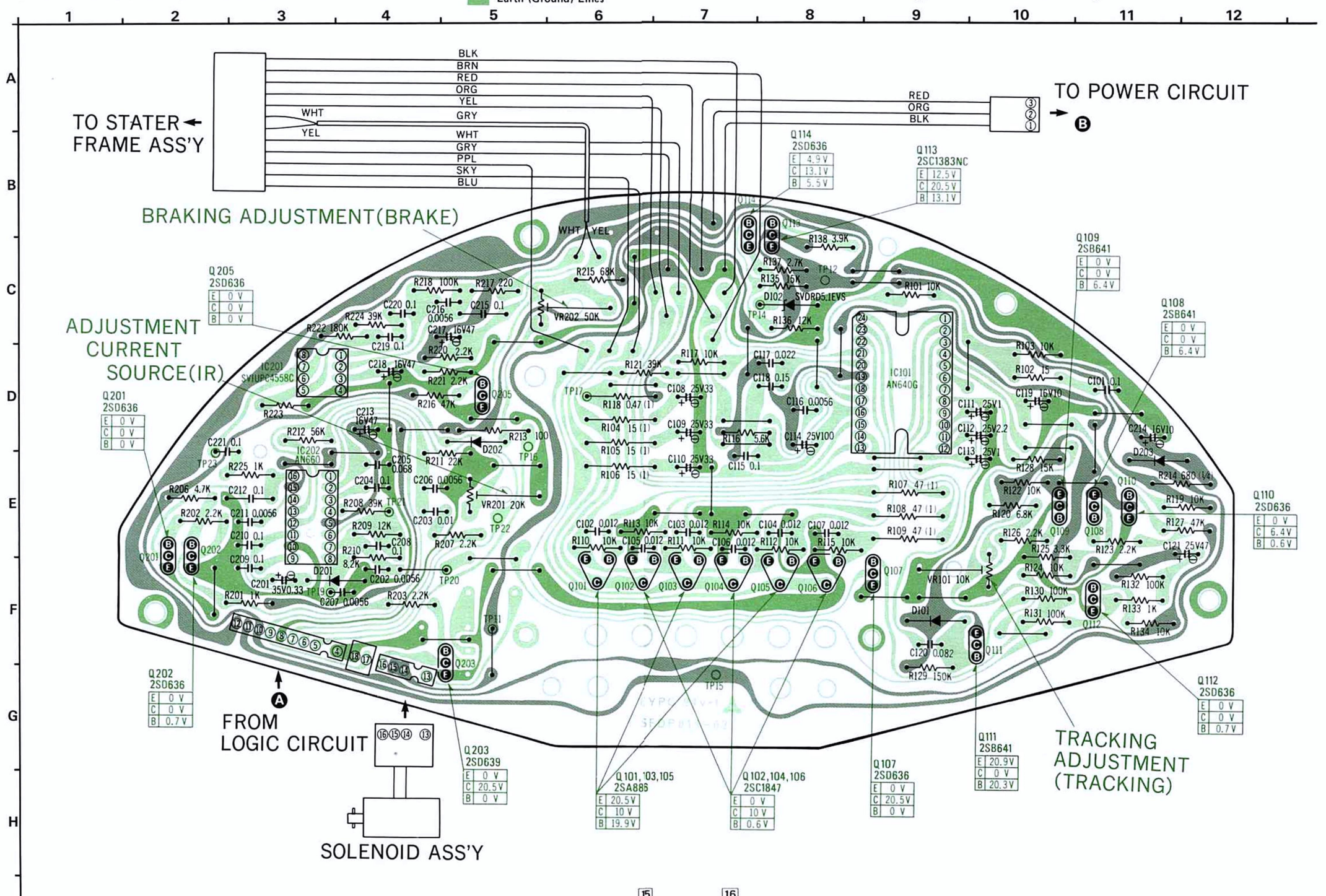
→ IC305
Q302 ~ 304

■ BLOCK DIAGRAM



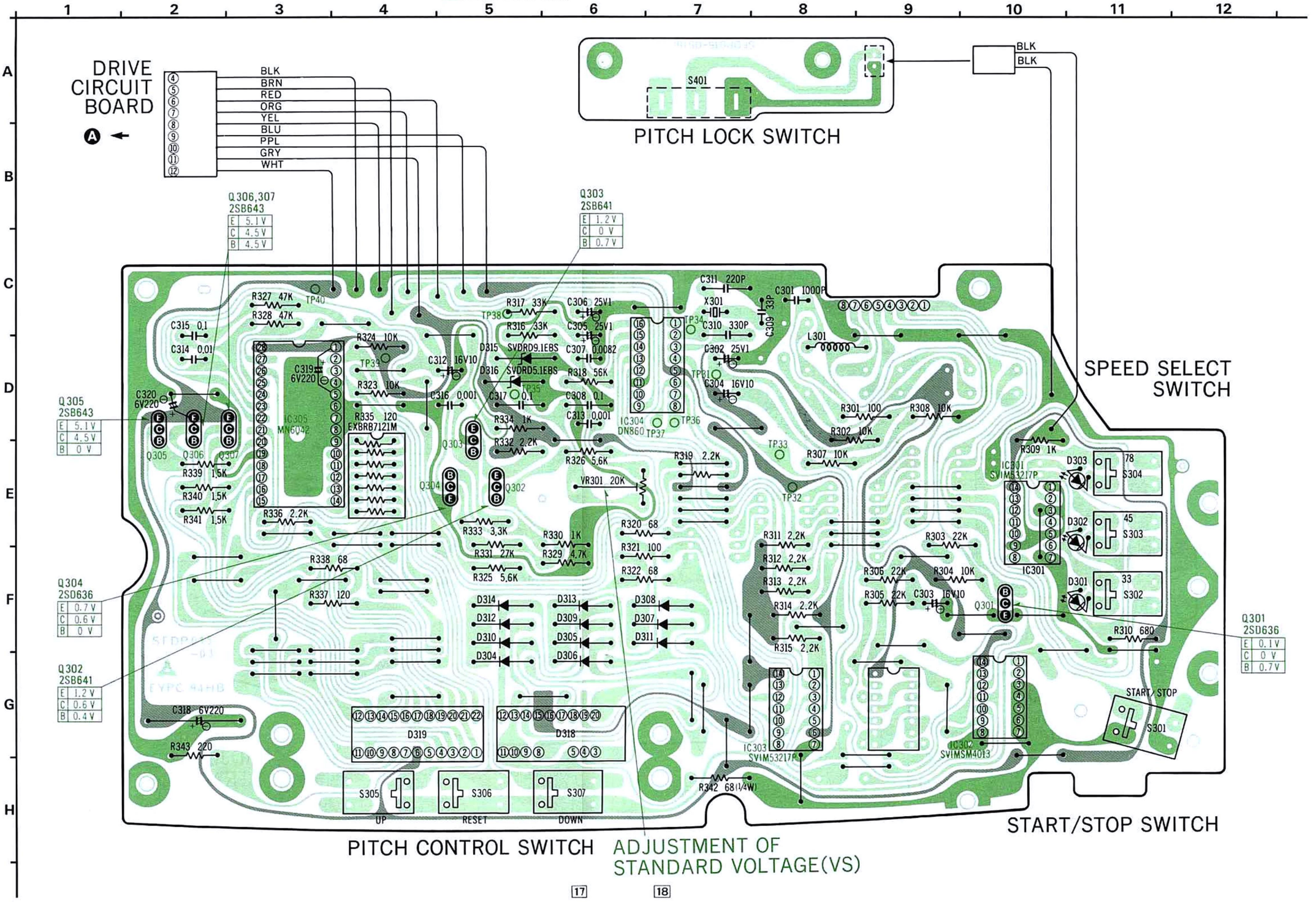
Printed Circuit Board (Drive Circuit)

⊕B Lines
Earth (Ground) Lines



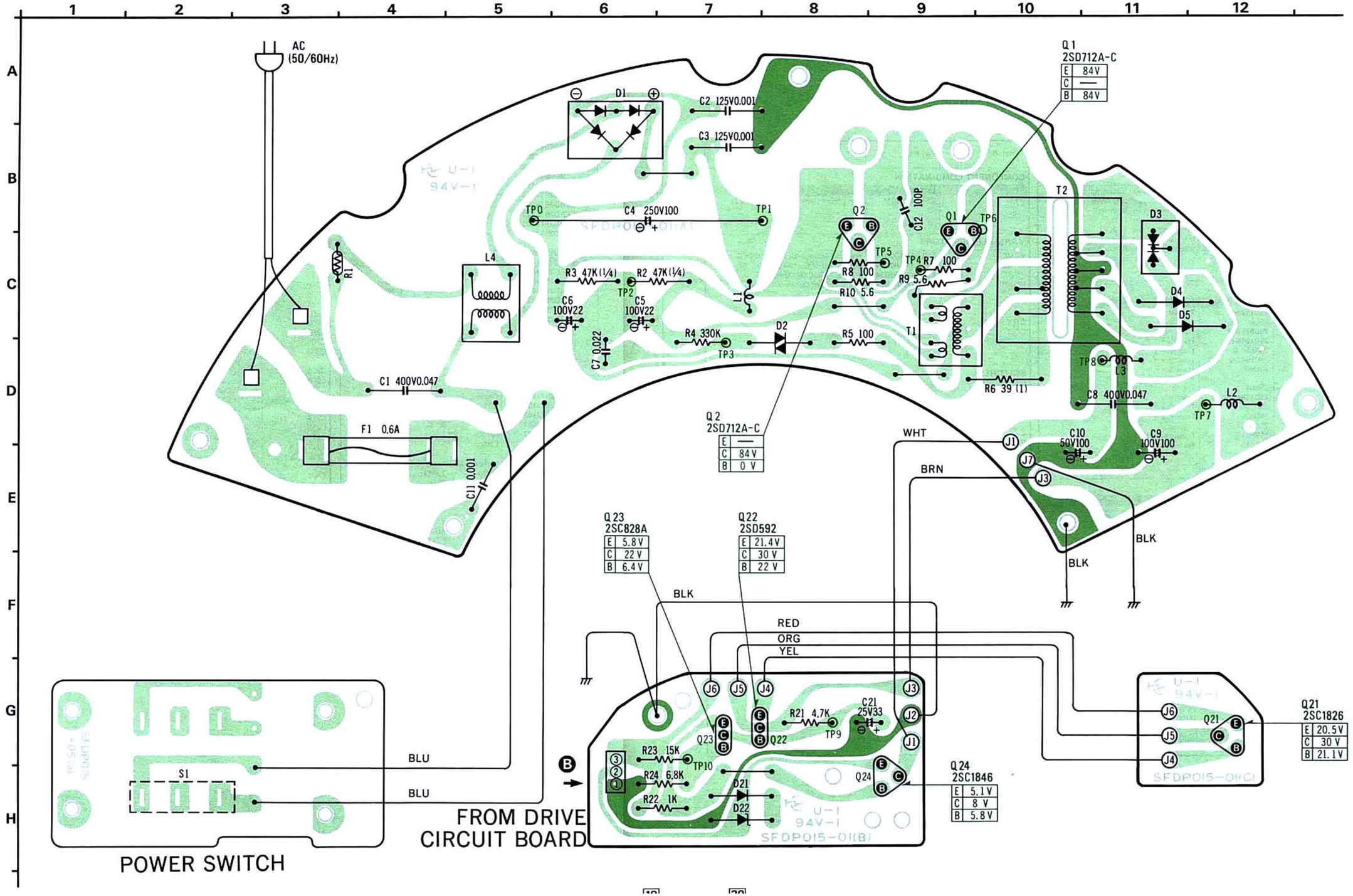
Printed Circuit Board (Logic Circuit)

⊕ B Lines
Earth (Ground) Lines



Printed Circuit Board (Power Circuit)

Earth (Ground) Lines



■ REPLACEMENT PARTS LIST

Important Safety Notice

Components identified by shaded area have special characteristics important for safety. When replacing any of these components use only manufacturer's specified parts.

Notes: 1. Part numbers are indicated on most mechanical parts. Please use this part number for parts orders.
2. SP-15 (M) → [M], SP-15 (MC) → [MC].

Ref. No.	Part No.	Part Name & Description
INTEGRATED CIRCUITS		
IC101	AN640G	Integrated Circuit (Drive)
IC201	SVIUPC4558C	Integrated Circuit (FG AMP)
IC202	AN660	Integrated Circuit (Control)
IC301, 303	SVIM53217P	Integrated Circuit (TTL)
IC302	SVIMSM4013	Integrated Circuit (CMOS)
IC304	DN860	Integrated Circuit (Frequency Divider)
IC305	MN6042	Integrated Circuit (Pitch Control)
TRANSISTORS		
Q1, 2	2SD712A-C	Transistor
Q21	**2SC1826-Y**	Transistor
Q22	2SD592AE-R	Transistor
Q23	**2SC828A-R**	Transistor
Q24	**2SC1846-R**	Transistor
Q101, 103, 105	2SA886-Q	Transistor } Use pair ranks
Q102, 104, 106	2SC1847-Q	Transistor } Use pair ranks
Q107, 110, 112, 114	2SD636	Transistor
Q108, 109, 111	2SB641	Transistor
Q113	**2SC1384A-R**	Transistor
Q201, 202, 205	2SD636	Transistor
Q203	2SD639	Transistor
Q301, 304	2SD636	Transistor
Q302, 303	2SB641	Transistor
Q305, 306, 307	2SB643	Transistor
DIODES		
D1	SVDS1RBA40	Rectifier
D2	SVDS1S2093	Diode
D3	SVDCTU22S	Diode
D4, 5	SVDV19C	Diode
D201, 101, 201 202, 203	MA150	Diode
D22, 102	SVDRD5, 1EBS	Diode, Zener 5.1V
D301, 302, 303	SVDSR105C	Light Emitting Diode
D304 ~ 314	MA150	Diode
D315	SVDRD9.1EBS	Diode, Zener 9.1V
D316	SVDRD5.1EBS	Diode, Zener 5.1V
D318	SVDGL7R204	Diode, rpm Indication
D319	SVDGL7R203	Diode, Pitch Indication
D320	SVDIS1887	Diode, Solenoid
COILS and TRANSFORMERS		
L1	SLQ1025T-201	Coil
L2	SLQ1016D-800	Coil
L3	SLQ809D-300	Coil
L4	ELF18D305	Filter
L301	SLQ0406S102K	Transformer
T1	SLT12K6A	Transformer
T2	SLT25K3A	Chock Coil

Ref. No.	Part No.	Part Name & Description
COMPONENT COMBINATION		
R1	ERTD3FEK8R0S	Thermistor
R335	EXBRB7121M	Component Combination (120Ω x 7)
VARIABLE RESISTORS		
VR101	**EVLS3AA00B14**	Tracking Adjustment (TRACKING)
VR201	**EVLS3AA00B24**	Adjustment of Current Source (IR)
VR202	**EVLS3AA00B54**	Braking Adjustment (BRAKE)
VR301	**EVLS3AA00B24**	Adjustment of Standard Voltage (VS)
CRYSTAL		
X301	SVQU306115	4.19328MHz Oscillator
SWITCHES		
S1	SFDSSS5GL132	Switch, Power
S301 ~ 307	EVQP1R04K	Switch
S401	SFDSSS5GL13C	Switch, Pitch Lock
FUSE		
F1	XBA2F06NU100	Fuse, 0.6A
RESISTORS		
R2, 3	**ERD25TJ473**	Carbon, 47kΩ, 1/4W, ± 5%
R4	**ERD25TJ334**	Carbon, 330kΩ, 1/4W, ± 5%
R5	**ERD25TJ101**	Carbon, 100Ω, 1/4W, ± 5%
R6	ERG1ANJ330	Metallic, 33Ω, 1W, ± 5%
R7, 8	**ERD25TJ101**	Carbon, 100Ω, 1/4W, ± 5%
R9, 10	**ERD25TJ5R6**	Carbon, 5.6Ω, 1/4W, ± 5%
R21	**ERD25TJ472**	Carbon, 4.7kΩ, 1/4W, ± 5%
R22	**ERD25TJ102**	Carbon, 1kΩ, 1/4W, ± 5%
R23	**ERD25TJ153**	Carbon, 15kΩ, 1/4W, ± 5%
R24	**ERD25TJ682**	Carbon, 6.8kΩ, 1/4W, ± 5%
R101	**ERD25TJ103**	Carbon, 10kΩ, 1/4W, ± 5%
R102	**ERD25TJ150**	Carbon, 15Ω, 1/4W, ± 5%
R103	**ERD25TJ103**	Carbon, 10kΩ, 1/4W, ± 5%
R104 ~ 106	ERG1ANJP150	Metallic, 15Ω, 1W, ± 5%
R107 ~ 109	ERG1ANJP470	Metallic, 47Ω, 1W, ± 5%
R110 ~ 115	**ERD25TJ103**	Carbon, 10kΩ, 1/4W, ± 5%
R116	**ERD25TJ562**	Carbon, 5.6kΩ, 1/4W, ± 5%
R117	**ERD25TJ103**	Carbon, 10kΩ, 1/4W, ± 5%
R118	ERX1ANJPR47	Metallic, 0.47Ω, 1W, ± 5%
R119	**ERD25TJ103**	Carbon, 10kΩ, 1/4W, ± 5%
R120	**ERD25TJ682**	Carbon, 6.8kΩ, 1/4W, ± 5%
R121	**ERD25TJ393**	Carbon, 39kΩ, 1/4W, ± 5%
R122	**ERD25TJ103**	Carbon, 10kΩ, 1/4W, ± 5%
R123	**ERD25TJ222**	Carbon, 2.2kΩ, 1/4W, ± 5%
R124	**ERD25TJ103**	Carbon, 10kΩ, 1/4W, ± 5%

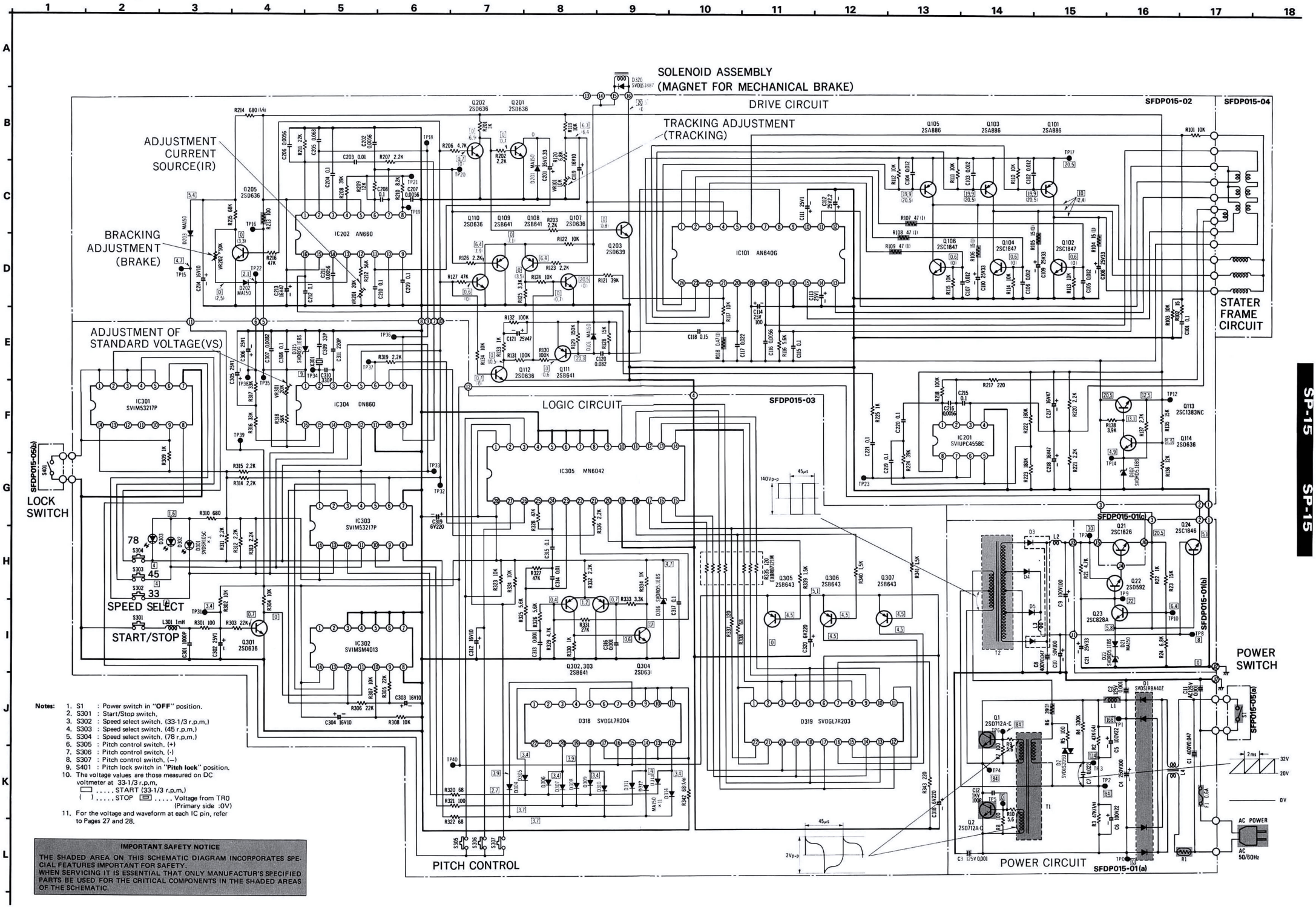
SP-15

Ref. No.		Part No.	Part Name & Description			
R125		**ERD25TJ332**	Carbon,	3.3kΩ,	1/4W,	± 5%
R126		**ERD25TJ222**	Carbon,	2.2kΩ,	1/4W,	± 5%
R127		**ERD25TJ473**	Carbon,	47kΩ,	1/4W,	± 5%
R128		**ERD25TJ153**	Carbon,	15kΩ,	1/4W,	± 5%
R129		**ERD25TJ154**	Carbon,	150kΩ,	1/4W,	± 5%
R130 ~ 132		**ERD25TJ104**	Carbon,	100kΩ,	1/4W,	± 5%
R133		**ERD25TJ102**	Carbon,	1kΩ,	1/4W,	± 5%
R134		**ERD25TJ103**	Carbon,	10kΩ,	1/4W,	± 5%
R135		**ERD25TJ153**	Carbon,	15kΩ,	1/4W,	± 5%
R136		**ERD25TJ123**	Carbon,	12kΩ,	1/4W,	± 5%
R137		**ERD25TJ272**	Carbon,	2.7kΩ,	1/4W,	± 5%
R138		**ERD25TJ392**	Carbon,	3.9kΩ,	1/4W,	± 5%
R201		**ERD25TJ102**	Carbon,	1kΩ,	1/4W,	± 5%
R202, 203		**ERD25TJ222**	Carbon,	2.2kΩ,	1/4W,	± 5%
R206		**ERD25TJ472**	Carbon,	4.7kΩ,	1/4W,	± 5%
R207		**ERD25TJ222**	Carbon,	2.2kΩ,	1/4W,	± 5%
R208		**ERD25TJ393**	Carbon,	39kΩ,	1/4W,	± 5%
R209		**ERD25TJ123**	Carbon,	12kΩ,	1/4W,	± 5%
R210		**ERD25TJ822**	Carbon,	8.2kΩ,	1/4W,	± 5%
R211		**ERD25TJ223**	Carbon,	22kΩ,	1/4W,	± 5%
R212		**ERD25TJ563**	Carbon,	56kΩ,	1/4W,	± 5%
R213		ERG1ANJ101	Metallic,	100Ω,	1W,	± 5%
R214		**ERD25TJ681**	Carbon,	680Ω,	1/4W,	± 5%
R215		**ERD25TJ683**	Carbon,	68kΩ,	1/4W,	± 5%
R216		**ERD25TJ473**	Carbon,	47kΩ,	1/4W,	± 5%
R217		**ERD25TJ221**	Carbon,	220Ω,	1/4W,	± 5%
R218		**ERD25TJ104**	Carbon,	100kΩ,	1/4W,	± 5%
R220, 221		**ERD25TJ222**	Carbon,	2.2kΩ,	1/4W,	± 5%
R222, 223		**ERD25TJ184**	Carbon,	180kΩ,	1/4W,	± 5%
R224		**ERD25TJ393**	Carbon,	39kΩ,	1/4W,	± 5%
R301		**ERD25TJ101**	Carbon,	100Ω,	1/4W,	± 5%
R302		**ERD25TJ103**	Carbon,	10kΩ,	1/4W,	± 5%
R303		**ERD25TJ223**	Carbon,	22kΩ,	1/4W,	± 5%
R304		**ERD25TJ103**	Carbon,	10kΩ,	1/4W,	± 5%
R305, 306		**ERD25TJ223**	Carbon,	22kΩ,	1/4W,	± 5%
R307, 308		**ERD25TJ103**	Carbon,	10kΩ,	1/4W,	± 5%
R309		**ERD25TJ102**	Carbon,	1kΩ,	1/4W,	± 5%
R310		**ERD25TJ681**	Carbon,	680Ω,	1/4W,	± 5%
R311 ~ 315		**ERD25TJ222**	Carbon,	2.2kΩ,	1/4W,	± 5%
R316, 317		**ERD25TJ333**	Carbon,	33kΩ,	1/4W,	± 5%
R318		**ERD25TJ563**	Carbon,	56kΩ	1/4W,	± 5%
R319		**ERD25TJ222**	Carbon,	2.2kΩ,	1/4W,	± 5%
R320		**ERD25TJ680**	Carbon,	68Ω,	1/4W,	± 5%
R321		**ERD25TJ101**	Carbon,	100Ω,	1/4W,	± 5%
R322		**ERD25TJ680**	Carbon,	68Ω,	1/4W,	± 5%
R323, 324		**ERD25TJ103**	Carbon,	10kΩ,	1/4W,	± 5%
R325, 326		**ERD25TJ562**	Carbon,	5.6kΩ,	1/4W,	± 5%
R327, 328		**ERD25TJ473**	Carbon,	47kΩ,	1/4W,	± 5%
R329		**ERD25TJ472**	Carbon,	4.7kΩ,	1/4W,	± 5%
R330		**ERD25TJ102**	Carbon,	1kΩ,	1/4W,	± 5%
R331		**ERD25TJ273**	Carbon,	27kΩ,	1/4W,	± 5%
R332		**ERD25TJ272**	Carbon,	2.7kΩ,	1/4W,	± 5%
R333		**ERD25TJ332**	Carbon,	3.3kΩ,	1/4W,	± 5%
R334		**ERD25TJ102**	Carbon,	1kΩ,	1/4W,	± 5%
R336		**ERD25TJ222**	Carbon,	2.2kΩ,	1/4W,	± 5%
R337		**ERD25TJ121**	Carbon,	120Ω,	1/4W,	± 5%
R338		**ERD25TJ680**	Carbon,	68Ω,	1/4W,	± 5%
R339 ~ 341		**ERD25TJ152**	Carbon,	1.5kΩ,	1/4W,	± 5%
R342		**ERD25TJ680**	Carbon,	68Ω,	1/4W,	± 5%
R343		**ERD25TJ221**	Carbon,	220Ω,	1/4W,	± 5%

Ref. No.		Part No.	Part Name & Description			
CAPACITORS						
C1 [M]		ECQM4473KZ	Polyester,	0.047μF,	400V,	±10%
C1 [MC]		ECQU1A473MC	Polyester,	0.047μF,	400V,	±10%
C2, 3		ECQU1A102MD	Polyester,	0.001μF,	125V	±20%
C4		ECEB250V100U	Electrolytic,	100μF,	250V	
C5, 6		**ECEA2AS200**	Electrolytic,	22μF,	100V	
C7		ECQM1H223KZ	Polyester,	0.022μF,	50V,	±10%
C8		ECQM4473KZ	Polyester,	0.047μF,	400V,	±10%
C9		**ECEA2AS101**	Electrolytic,	100μF,	100V,	
C10		**ECEA1HS101**	Electrolytic,	100μF,	16V,	
C11		ECQU1A102MD	Polyester,	0.001μF,	125V	±20%
C12		ECKD3A101MB2	Ceramic,	100pF,	10V	
C21		**ECEA1VS330**	Electrolytic,	33μF,	35V	
C101		ECQM1H104KZ	Polyester,	0.1μF,	50V,	±10%
C102 ~ 107		ECQM1H123KZ	Polyester,	0.012μF,	50V,	±10%
C108 ~ 110		**ECEA1VS330**	Electrolytic	33μF,	35V	
C111		ECSF25E1ZEN	Tantalum,	1μF,	25V	
C112		ECSF25E2R2Z	Tantalum,	2.2μF,	25V	
C113		ECS25E1ZEN	Tantalum,	1μF,	25V	
C114		**ECEA25Z100**	Electrolytic,	100μF,	25V	
C115		ECQM1H104KZ	Polyester,	0.1μF,	50V,	±10%
C116		ECQM1H562KZ	Polyester,	0.0056μF,	50V,	±10%
C117		ECQM1H223KZ	Polyester,	0.022μF,	50V,	±10%
C118		ECQM1H154KZ	Polyester,	0.15μF,	50V,	±10%
C119		**ECEA1HS100**	Electrolytic,	10μF,	50V	
C120		ECQM1H823KZ	Polyester,	0.082μF,	50V,	±10%
C121		**ECEA1ES470**	Electrolytic,	47μF,	25V	
C201		ECSF35ER33	Tantalum,	0.33μF,	35V	
C202		ECQM1H562KZ	Polyester,	0.0056 F,	50V,	±10%
C203		ECQM1H103KZ	Polyester,	0.01μF,	50V,	±10%
C204		ECQM1H104KZ	Polyester,	0.1μF,	50V,	±10%
C205		ECQM1H683JZ	Polyester,	0.068μF,	50V,	± 5%
C206		ECQM1H562KZ	Polyester,	0.0056μF,	50V,	±10%
C208 ~ 210		ECQM1H104KZ	Polyester,	0.1μF,	50V,	±10%
C211		ECQM1H562KZ	Polyester,	0.0056μF,	50V,	±10%
C212		ECKD1E104ZFZ	Ceramic,	0.1μF,	25V	
C213		**ECEA1ES470**	Electrolytic,	47μF,	25V	
C214		**ECEA1HS100**	Electrolytic,	10μF,	50V	
C215		ECKD1E104ZFZ	Ceramic,	0.1μF,	25V	
C216		ECQM1H562KZ	Polyester,	0.0056μF,	50V,	±10%
C217, 218		ECEA1ES470	Electrolytic,	47μF,	25V	
C219 ~ 221		ECQM1H104KZ	Polyester,	0.1μF,	50V,	±10%
C301		ECKD1H102MD	Ceramic,	0.001μF,	50V,	±20%
C302		ECSF25E1ZEN	Tantalum,	1μF,	25V	
C303, 304		**ECEA1HS100**	Electrolytic,	100μF,	50V	
C305, 306		ECSF25E1ZEN	Tantalum,	1μF,	25V	
C307		ECQM1H822KZ	Polyester,	0.0082μF,	50V,	±10%
C308		ECKD1E104ZFZ	Ceramic,	0.1μF,	25V	
C309		ECCD1H330K	Ceramic,	33pF,	50V	
C310		ECCD1H331K	Ceramic,	330pF,	50V	
C311		ECCD1H221K	Ceramic,	220pF,	50V	
C312		**ECEA1HS100**	Electrolytic,	10μF,	50V	
C313		ECQM1H102KZ	Polyester,	0.001μF,	50V,	±10%
C314		ECQM1H103KZ	Polyester,	0.01μF,	50V,	±10%
C315		ECQM1H104KZ	Polyester,	0.1μF,	50V,	±10%
C316		ECQM1H102KZ	Polyester,	0.001μF,	50V,	±10%
C317		ECKD1E104ZFZ	Ceramic,	0.1μF,	25V	
C318		**ECEB1AS221**	Electrolytic,	220μF,	10V	
C319, 320		**ECEA1AS221**	Electrolytic,	220μF,	10V	

Schematic Diagram

(This schematic diagram may be at any time with the development of new technology)



Notes:

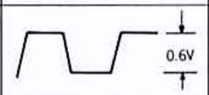
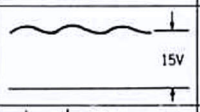
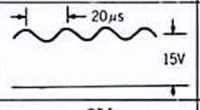
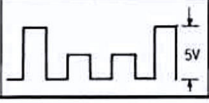
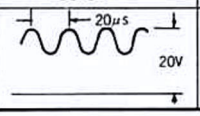
1. S1 : Power switch in "**OFF**" position.
2. S301 : Start/Stop switch.
3. S302 : Speed select switch. (33-1/3 r.p.m.)
4. S303 : Speed select switch. (45 r.p.m.)
5. S304 : Speed select switch. (78 r.p.m.)
6. S305 : Pitch control switch. (+)
7. S306 : Pitch control switch. (-)
8. S307 : Pitch control switch. (—)
9. S401 : Pitch lock switch in "**Pitch lock**" position.
10. The voltage values are those measured on DC voltmeter at 33-1/3 r.p.m.
    □ ..... START (33-1/3 r.p.m.)
    ( ) ..... STOP ▭ ..... Voltage from TR0 (Primary side :0V)
11. For the voltage and waveform at each IC pin, refer to Pages 27 and 28.

IMPORTANT SAFETY NOTICE

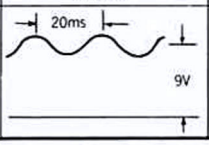
THE SHADED AREA ON THIS SCHEMATIC DIAGRAM INCORPORATES SPECIAL FEATURES IMPORTANT FOR SAFETY.
WHEN SERVICING IT IS ESSENTIAL THAT ONLY MANUFACTUR'S SPECIFIED PARTS BE USED FOR THE CRITICAL COMPONENTS IN THE SHADED AREAS OF THE SCHEMATIC.

■ REFERENCE VOLTAGE AND WAVEFORM AT EACH IC PIN

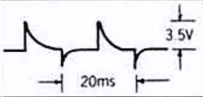
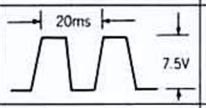
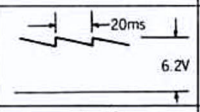
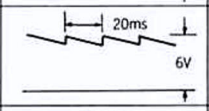
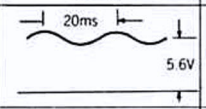
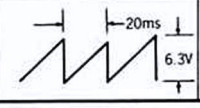
IC101 (AN640G)

	Start	Stop		Start	Stop		Start	Stop
① ② ③		0 V	⑩ ⑫ ⑭		15 V	⑲	20.5V	20.5V
						⑳	15.4V	1.4V
						㉑	20.6V	16.4V
④	6.3V	6.4V	⑪		Same as at left	㉒ ㉓ ㉔	19.9V	20.5V
⑤	6.3V	7.9V	⑬					
⑥	4.8V	2.2V	⑮					
⑦	5 V	5 V	⑯	0V	0 V			
⑧	20.5V	20.5V	⑰	15.5V	15.5V			
⑨		0.2V	⑱		Same as at left			

IC201 (SVIUPC4558C)

	Start	Stop		Start	Stop
① ⑤ ⑥ ⑦		9V	② ③	9 V	9 V
			④	0 V	0 V
			⑧	17.6V	17.6V

IC202 (AN660)

	Start	Stop		Start	Stop		Start	Stop
①		0 V	⑤	12.6V	Same as at left	⑫	2.4V	2.1V
			⑥	6.3V		⑬	2.2V	2.1V
			⑦	6.5V	8 V	⑭		7.5V
②		0 V	⑧	6.3V	5.1V			
			⑨		7.5V	⑮	12.5V	12.5V
③		5.8V	⑩	0 V	0 V	⑯		5.6V
④	5.8V	6 V	⑪		7.5V			

IC301 (SVIM53217P)

	Start	Stop
①	0.2V	0.2V
②	0 V	0 V
③	0.2V	0.2V
④	0 V	0 V
⑤	0.2V	0.2V
⑥ ⑦ ⑧	0 V	0 V
⑨	0.2V	0.2V
⑭	5.1V	5.1V

IC302 (SVIMSM4013)

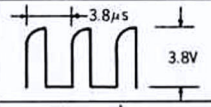
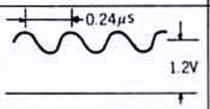
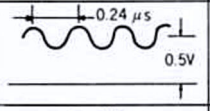
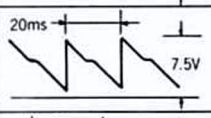
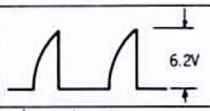
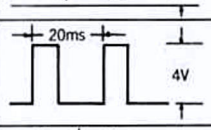
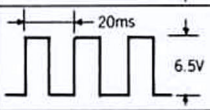
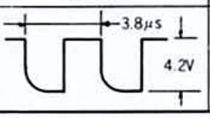
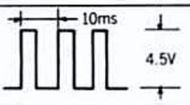
	Start	Stop
③ ④ ⑤ ⑥ ⑦ ⑧	0 V	0 V
⑨	0 V	4.7V
⑩ ⑪	0 V	0 V
⑫	0 V	4.7V
⑬	4.7V	0 V
⑭	4.7V	4.7V

IC303 (SVIM53217P)

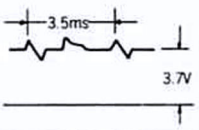
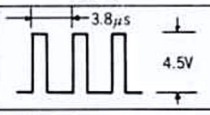
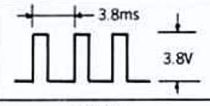
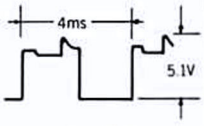
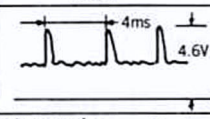
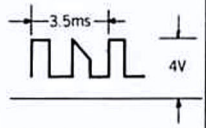
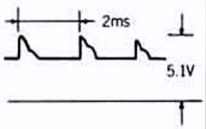
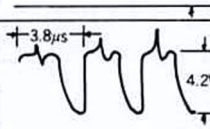
	Start	Stop
①	0.1V	4.2V
③	0 V	4.7V
④	0.1V	4.2V
⑤	4.7V	0 V
⑥	3.2V	0 V
⑦	0 V	0 V
⑧	3.8V	3.8V
⑨	4 V	4 V
⑩	3.8V	3.8V
⑪	4 V	4 V
⑫	0.4V	0.4V
⑬	0 V	0 V
⑭	5.1V	5.1V

■ REFERENCE VOLTAGE AND WAVEFORM AT EACH IC PIN

IC304 (DN860)

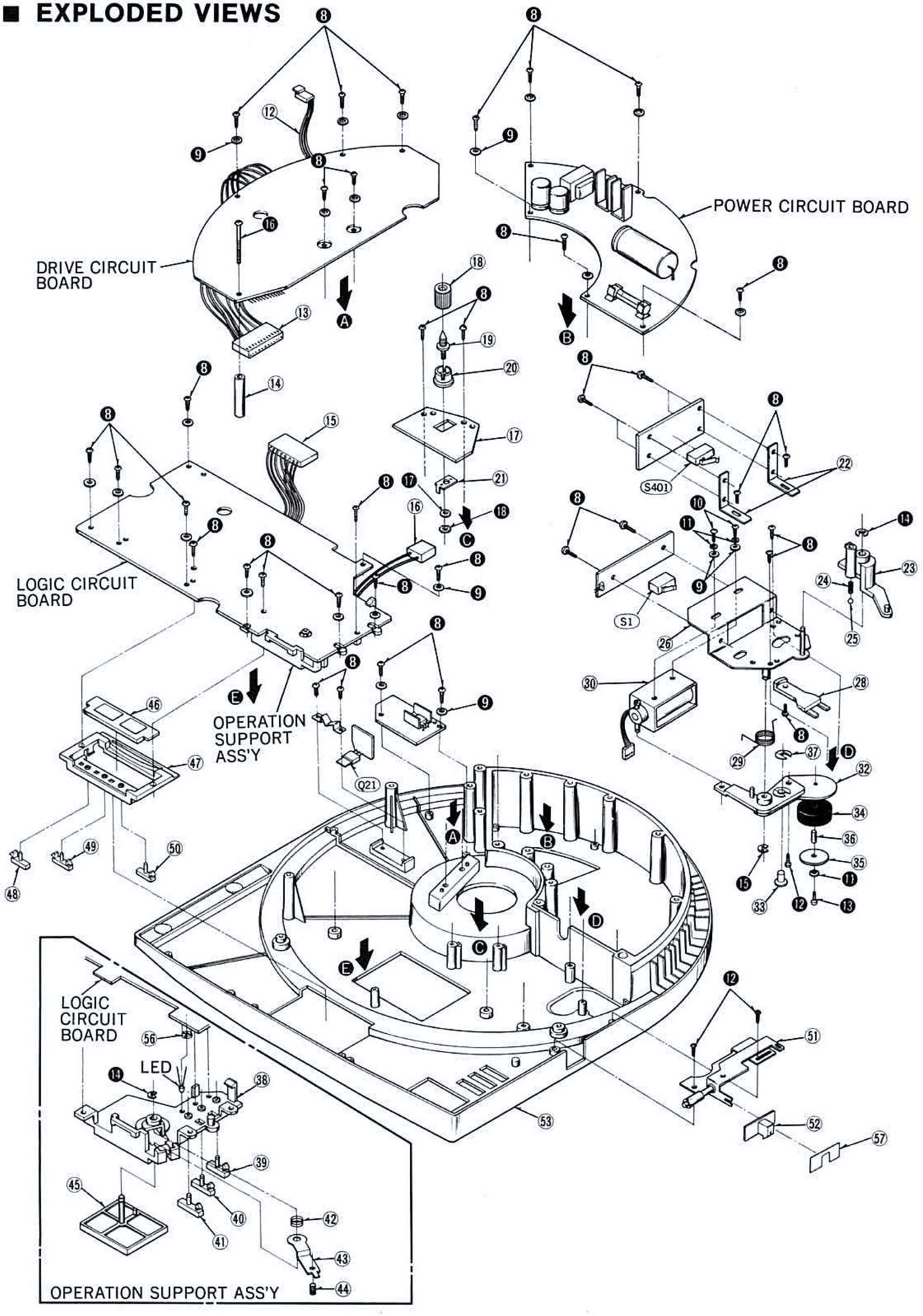
	Start	Stop		Start	Stop		Start	Stop
①	9.3V	9.3V	⑦		Same as at left	⑪	0V	0V
②		Same as at left				⑫ ⑬	4V	4V
③		Same as at left	⑧		0V	⑭	0V	0V
④	0 V	3.2V				⑮		Same as at left
⑤	3.2V	0 V	⑨		4V	⑯		0V
⑥		Same as at left	⑩		Same as at left			

IC305 (MN6042)

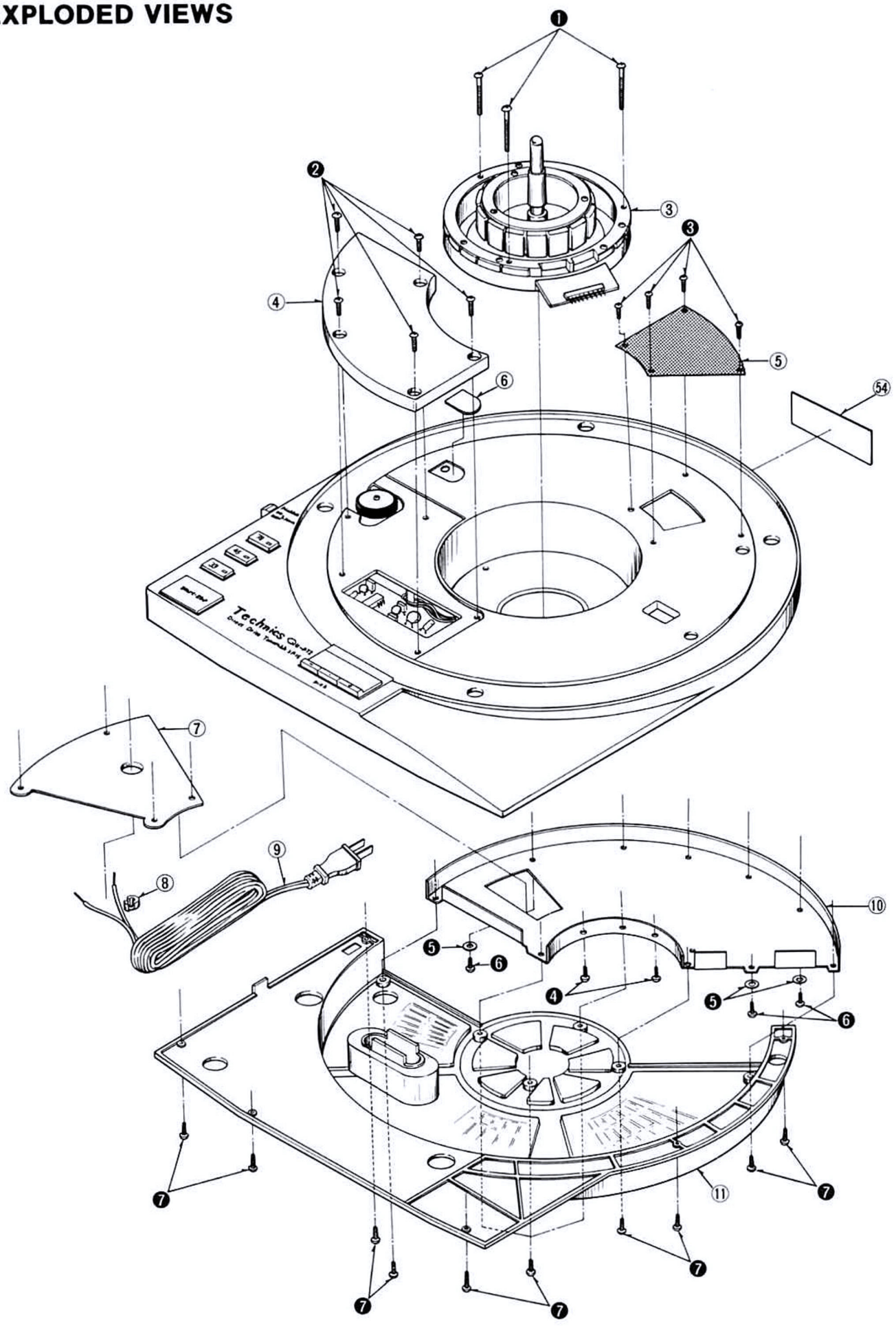
	Start	Stop		Start	Stop		Start	Stop
① ② ③ ㉗ ㉘	4.6V	4.6V	⑯		Same as at left	㉑		Same as at left
						㉒		Same as at left
④⑧ ⑤⑨ ⑥⑲ ⑦	0 V	0 V	⑰ ⑱		Same as at left	㉓	1.8V	1.8V
						㉔	2.2V	2.2V
						㉕		Same as at left
⑩ ⑪ ⑫ ⑬ ⑭ ⑮		Same as at left	⑳		Same as at left	㉖		Same as at left

— NOTE —

■ EXPLODED VIEWS



■ EXPLODED VIEWS



■ REPLACEMENT PARTS LIST

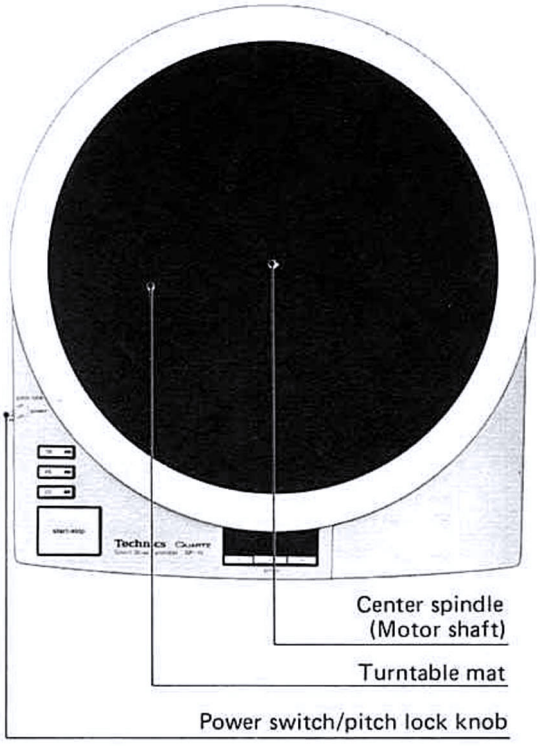
Important Safety Notice

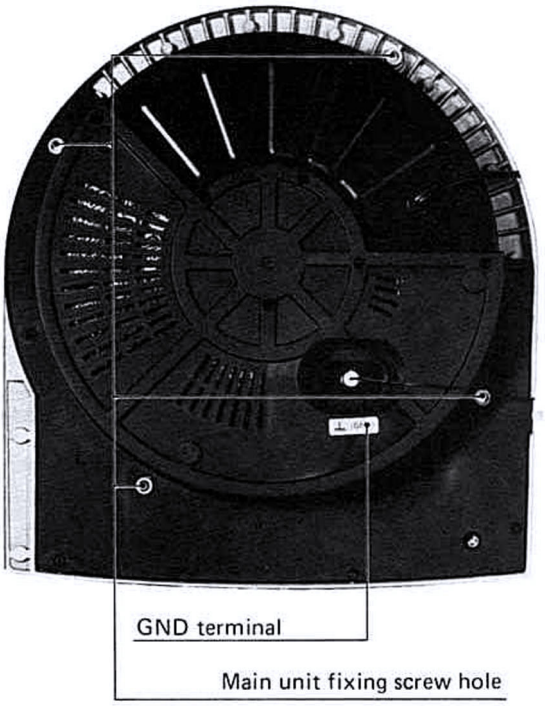
Components identified by shaded area have special characteristics important for safety. When replacing any of these components use only manufacturer's specified parts.

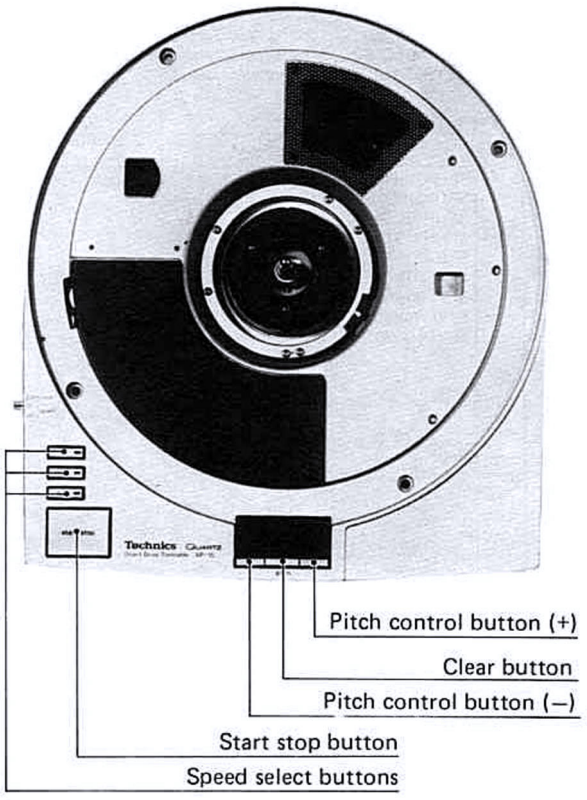
Notes: 1. Part numbers are indicated on most mechanical parts. Please use this part number for parts orders.
2. SP-15 (M) → [M], SP-15 (MC) → [MC].

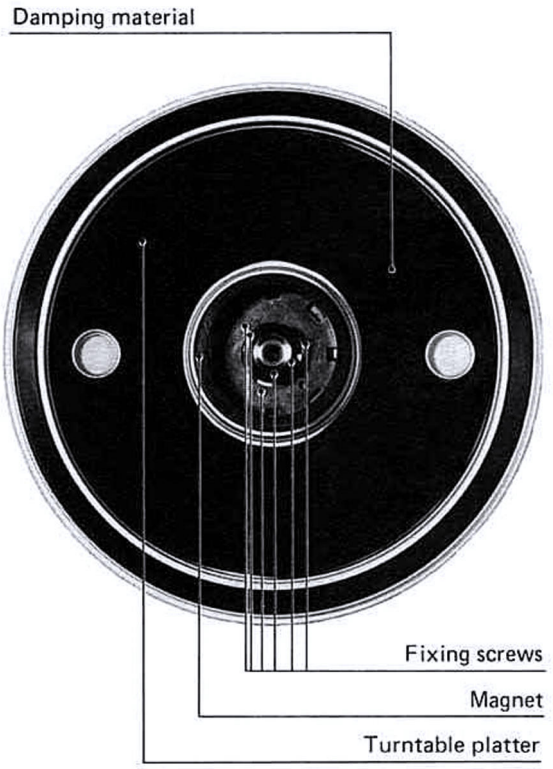
Ref. No.		Part No.	Part Name & Description
CABINET and CHASSIS PARTS			
1		SFTG015-01	Turntable Mat
2		SFTE015-01A	Turntable
3		SFMZ015-02Z	Stater Frame Ass'y
4		SFUM015-07	Cover, Turntable
5		SFUP015-09	Plate, Shield, Turntable
6		SFUP015-13	Cap, Turntable
7		SFUP015-11	Plate, AC Cord
8		SFHK040L	Bushing, AC Cord
9		**QFC1201MA**	AC Cord
10		SFUP015-12	Plate, Shield, Power Circuit
11		SFUM015-09	Cover, Bottom
12		SFDJ015-02E	Connector, Power Circuit
13		SFDJ134-01E	Connector, Stater Frame Ass'y
14		SFXO015-01	Pipe, Logic Circuit Screw
15		SFDJ015-03E	Connector, Drive
16		SFDJ015-01E	Connector, Pitch Lock Switch
17		SFUP015-04	Plate, Ground Wire
18		SNE273-1	Knob, Ground Terminal
19		SNE271S	Screw, Ground Terminal
20		SGE401	Ornament, Ground Terminal
21		SJT719	Spacer, Ground Terminal
22		SFUP015-10	Bracket, Power Circuit
23		SFUM015-03	Cam, Power Switch
24		SFQA015-02	Spring, Power Switch Cam
25		SFYB-M30	Ball, Power Switch Cam
26		SFUP015-03E	Bracket, Power Switch
28		SFUM015-04	Cam, Pitch Lock Switch
29		SFQS015-01	Spring, Brake
30		SFDZ015-01E	Solenoid Ass'y
32		SFUM015-06E	Brake Ass'y
33		SFXJ015-06	Shaft, Eccentricity
34		SFUZ015-01	Roller, Brake
35		SFUP015-14	Spacer, Roller
36		SFXO015-02	Pipe, Roller
37		SFXW130-01	Circlip, Roller
38		SFUM015-01	Plate, Operation
39		SFKT015-03E	Knob, Speed Select (78 rpm)
40		SFKT015-02E	Knob, Speed, Select (45 rpm)
41		SFKT015-01E	Knob, Speed Select (33 rpm)
42		SFQA015-01	Spring, Supporter
43		SFUP015-07	Supporter, Switch
44		SFRTN30060	Screw, Supporter
45		SFKT015-06	Knob, Start/Stop
46		SFUM015-05E	Supporter, Logic Circuit
47		SFUM015-62	Plate, Operation
48		SFKT015-08	Knob, Operation (C)
49		SFKT015-04	Knob, Operation (A)
50		SFKT015-05	Knob, Operation (B)
51		SFUP015-08Z	Plate, Slider
52		SFKT015-07	Knob, Power Switch
53		SFAC015-01	Cabinet, Panel
54 [M]		SFNN015M01	Name Plate
54 [MC]		SFNN015C01	Name Plate
56		SFUM015-11	Spacer, LED
57		SFUP015-15	Cover, Power Switch
SCREWS and CIRCLIPS			
❶		**XTN3+30B**	Screw
❷		**XTN3+8BFZ**	Screw
❸		**XTN3+6BFZ**	Screw
❹		**XTN3+10B**	Screw
❺		**XWG3FZ**	Washer
❻		**XTN3+10BFZ**	Washer
❼		**XTS3+10BFZ**	Washer
❽		**XTN3+8B**	Washer
❾		**XWG3**	Washer
❿		**XSN3+6S**	Screw
⓫		**XWA3B**	Washer
⓬		**XTN3+6B**	Screw
⓭		**XSN3+12S**	Screw
⓮		**XUC3FT**	Circlip
⓯		**XUC4FT**	Circlip
⓰		**XTN3+40B**	Screw
⓱		**XWA4B**	Washer
⓲		**XNG4ES**	Nut
ACCESSORIES			
A1 [M]		SFNU015M01	Instruction Book
A1 [MC]		SFNU015C01	Instruction Book
A2		SFWE212-01	Adaptor, 45 r.p.m
A3		SFEL028-01E	Ground Wire
A4		XMM41+32FU	Screw
A5		SFXW028-01	Washer
A6 [M]		SFNU015M02	Instruction, Dimension Drawing
A6 [MC]		SFNU015C02	Instruction, Dimension Drawing
A7		SFYF07A10	Polyethylene Bag
PACKING PARTS			
P1 [M]		SFHP015M01	Carton
P1 [MC]		SFHP015C01	Carton
P2		SFHH015-01	Pad (Left)
P3		SFHH015-02	Pad (Right)
P4		SFHH015-03	Pad
P5		SFHD015-01	Pad, Top
P6		SFYF60A60	Polyethylene Bag, Unit
P7		SFYH40X45	Polyethylene Bag, Turntable
P8		SFYF10A30	Polyethylene Bag, Cord

■ PARTS IDENTIFICATION









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